Cold Climate Housing Research Center

CCHRC

Hybrid Micro Energy Program
Award No. 01163
Quarterly Report: July 1, 2010 – September 30, 2010

By Michael Lilly, GW Scientific, Ryan Colgan and Robbin Garber-Slaght CCHRC
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Per the terms of the Hybrid Micro-Energy Program (HMEP) grant agreement, the three priority renewable energy systems to be evaluated are:

A small scale biomass combined heat and power (CHP) system that can convert wood into heat and power for use in small scale loads including residences, small community facilities, and potentially small communities and/or neighborhoods.

During the third quarter of 2010 CCHRC continued to investigate viable paths to advance a small scale biomass CHP demonstration project, while deciding to concurrently prepare a report documenting our findings relating to the small scale biomass CHP industry and our experience search for a system suitable for practical and economic use in Alaska.

A ground source heat pump project that includes solar thermal collection to recharge the ground temperature.

During the third quarter of 2010 CCHRC acquired the sensor and data acquisition system for the Weller Elementary School Ground Source Heat Pump (GSHP) project. The temperature collection system for the ground loop was installed and is in its final testing phase. Data collection should begin by the end of the fourth quarter.

Project partners began installing the heat pump system during the third quarter (Figure 1). The ground loop is completely installed and the sensor grid is in place. The solar thermal panels and the plumbing are all in place awaiting the arrival of the heat pump. The heat pump and all of the energy meters will be installed during the fourth quarter of 2010.

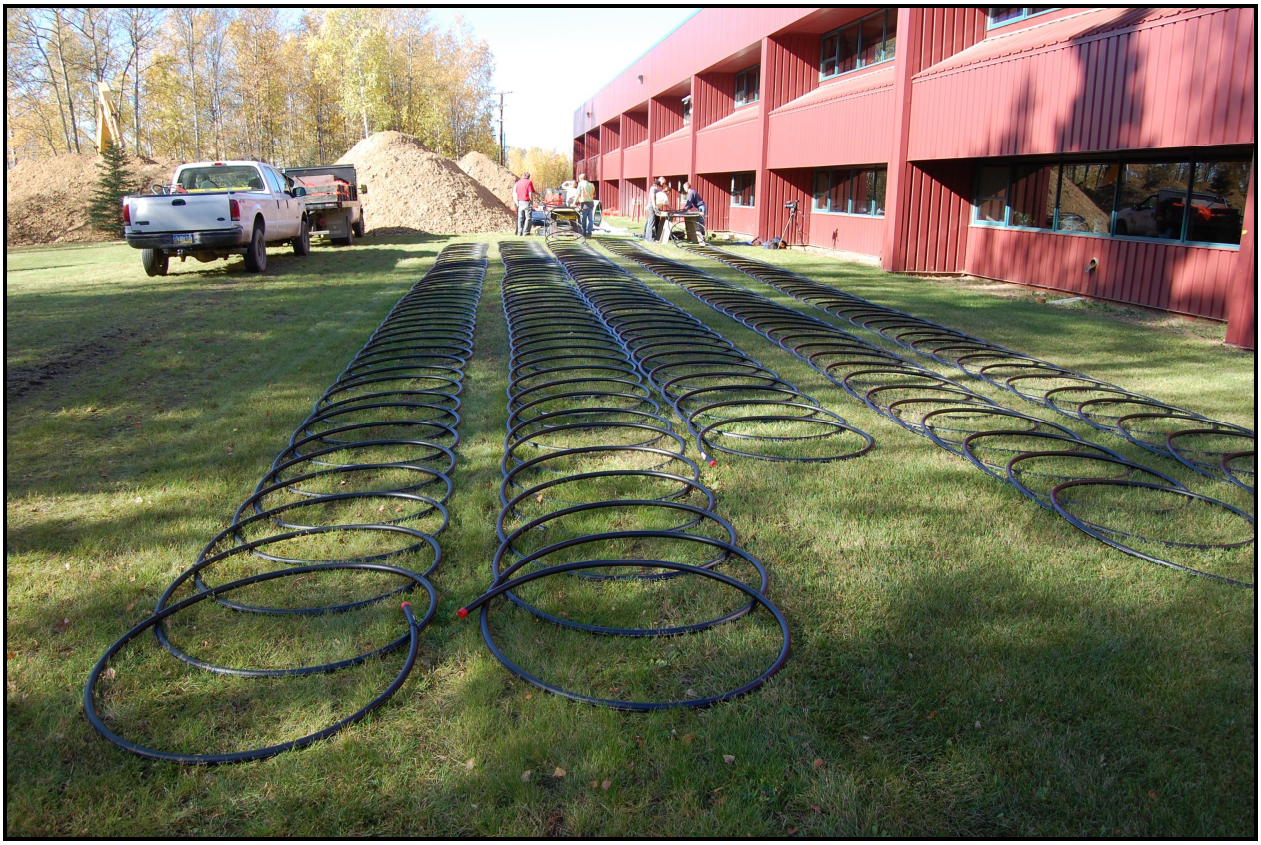

Figure 1. Ground source heat pump project preparations outside of Weller Elementary School during the fall of 2010.

Additionally, Robbin Garber-Slaght, CCHRC, gave an interactive presentation of the project to 100 fifth and sixth graders at Weller Elementary School. A news article on the presentation can be found at the following link: http://www.newsminer.com/view/full_story/10046125/article-School-renovation-is-a-lesson-plan-for-Weller-Elementary-students

A combined solar photovoltaics (PV) and wind system integrated into an energy efficient load design.

The Denali Commission funding is being utilized to monitor and report the performance of a combined solar photovoltaic (PV) and wind system (Figure 2) installed at the Anaktuvuk Pass house (A Sustainable Northern Community prototype house). The power systems were funded by the Yukon River Inter-Tribal Watershed Council (YRITWC), who is also a partner in the overall evaluation of the alternative energy systems. GW Scientific and Campbell Scientific are providing In-Kind matching support. CCHRC, YRITWC and GW Scientific comprise the main technical interpretative team. Remote Power Inc. has been providing valuable In-Kind matching technical support related to the wind and solar power systems.

A PV system was installed as part of the house construction during the summer of 2009. The 1.1 kWatt adjustable-mount array, has already recorded over 1.3 Mwatt-hours on the Fronius IG3000 Inverter. Data recording started in April on produced solar energy (Figure 3) shows that even in a high-latitude setting solar power can be positive energy source. This data, along with other collected parameters by the Campbell Scientific data collection stations will help demonstrate and improve the understanding of small-scale solar systems in extreme environments, like Anaktuvuk Pass. The project team is in the process of interpreting the data and performance issues. During the third quarter, YRITWC and GW Scientific team members visited Anaktuvuk Pass to work on the wind system inverters and collect site data from the solar system. The project team is continuing to work on the wind system integration into the battery-less design that can reduce power consumption from the local grid (Figure 4).

The hybrid power system is helping reduce the demand on the electrical usage from the village utility grid and has been serving as an active example of wind and solar power for the community residents and other villages in the North Slope Borough. It is also become a key stop for outside visitors to Anaktuvuk Pass. The combination of renewable energy systems and energy efficiency at the Anaktuvuk Pass prototype home is serving as an active demonstration of possibilities in sustainable northern shelters, while simultaneously serving as a valuable research platform for sustainable infrastructure that will impact future decisions. Results of the Denali Commission supported HMEP projects will become available on CCHRC's website.

Figure 2. The solar and wind systems in Anaktuvuk Pass. Both systems tie into the house AC power system and feedback to the grid when excess power is provided. This example system does not utilize battery banks for storage. (photo by M. Lilly, August 26, 2010)

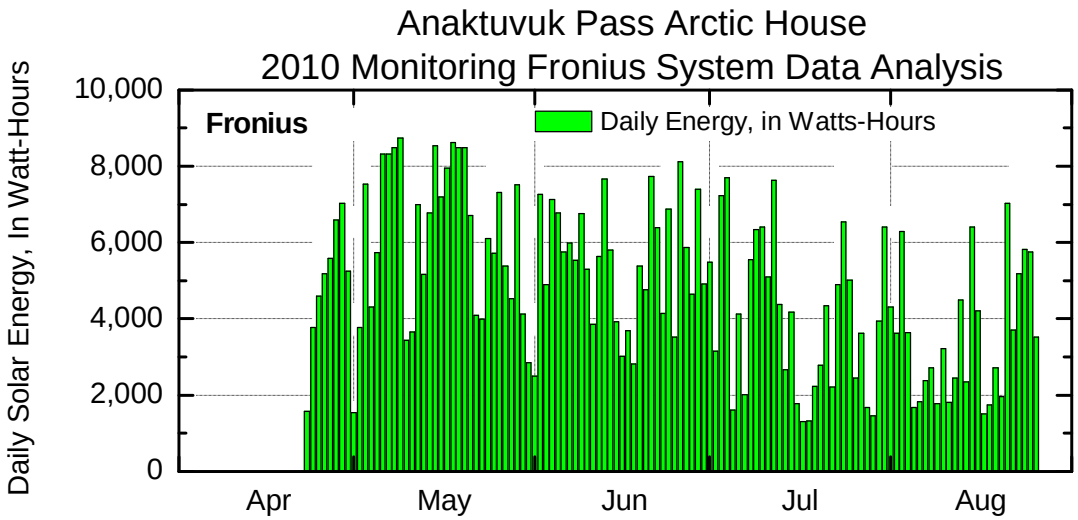

Figure 3. Daily produced solar energy recorded by the Fronius Inverter from April 2010 to a recent trip near the end of August. Recording the general solar system performance, investigating issues such as snow removal and solar panel installation angles, and benefits of reflection off of the snow during summer "fringe" seasons are part of the project objectives.

Figure 4. The project team including staff from Remote Power Inc., YRITWC, and GW Scientific have been working throughout the project on improving the understanding combining small-scale wind power system components. The above pictures shows a recent meeting at Remote Power Inc. Fairbanks shop where Dave Pelunis-Messier (YRITWC) is going over the wind turbine wild-AC to DC rectifier board and its integration into the SunnyBoy DC to DC inverter. The wind system directly connects to the main wiring panel of the house to help reduce power consumption from the local Anaktuvuk Pass power plant.